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**A Description of the Water-Mite, *Hydrovolzia gerhardi* new
species, with Observations on the Life History and Ecology**

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The peculiar distribution of water-mites belonging to the family Hydrovolziidae Thor (1905) has attracted the attention of many workers. This family contains three genera, *Hydrovolzia* Thor (1905), *Hydrovolziella* Viets (1935), and *Acherontacarus* Viets (1932). A key to these is given by Viets (1936). The genus *Acherontacarus* contains two named species and a larva, not named, has been assigned to it (Viets, 1934). The single described species of *Hydrovolziella*

H. lata Walter (1935) from southern Algeria has not been recorded since the original description.

Preliminary descriptions of four species of *Hydrovolzia*, one from Java and three from Burma, were published by Lundblad (1941) without habitat data or measurements. Walter (1928) described *H. in f ringata* from Darjeeling, India. Two other species, *H. oscensis* Viets (1930) from Spain and *H. vietsi* Angelier (1949) from the Pyrenee Mountains of France, are known only from the original descriptions. *H. placophora* Monti (1905) and *H. cancellata* Walter (1906) are rare but much is known of their distribution and ecology. Both are usually found in flowing waters having a temperature of less than 15° C. The animals, however, are taken in moss or algae where

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there are no immediate effects of current. *H. placophora* is known from the Faroe Islands, Sweden, mountains of central Germany, the Alps, and the Carpathian Mountains in Roumania.* This species is generally thought to be a glacial relict. *H. cancellata*, also limited to cold waters, is known from the Alps and nearby mountains of France and from Algeria. It also seems to be a relict species. This paper is the first detailed account of a member of the Hydrovolziidae from North America.

The fact that the closely related species of *Hydrovolzia* are found in widely separated localities over the northern hemisphere indicates their derivation from similar ancestral stock, possibly a single species once widely distributed over the northern continents ; and, if the habitat of the modern species is an indication, the climate at that time was much colder. Populations of *Hydrovolzia* seem to have survived as remnants in only a few favorable localities.

All species of *Hydrovolzia* are remarkably uniform in structure and chaetotaxy, and the only reliable specific characters are in the size and shape of the various body sclerites. These differences can be expressed quantitatively with accuracy and consistency. Measurements of the palps, while significant, are difficult to record with consistency. Of the many accounts of species of *Hydrovolzia* only seven were found that gave complete measurements of the body plates and each was based on a single specimen. Since specific differences are quantitative, the species can be delimited only if the range of variation is established. To date none of the Old World species have been defined from a series of specimens and the features of the proposed species are difficult to evaluate.

Genus Hydrovolzia

Coxae of the venter fused into four plates ; the anterior pair from fusion of coxae I and II, and the posterior pair from the fusion of III and IV. A simple setigerous glandularia located between the anterior and posterior coxal groups. Three pairs of bipartite lateroglandularia situated between the posterior coxal groups ; anterior pair large, irregularly-shaped, the other two pairs subequal. The glandularia consists of two parts ; the anterior setigerous sclerite, incised posteriorly, and a posterior pore-bearing sclerite that projects into the incision of the anterior sclerite. Two median sclerites present posterior to the genital field ; the anteriorly-placed anal plate, and the post-anal plate. Ventral plates of the male usually larger than those of female.

*The record of Habeeb (1950) of *H. placophora* from New Brunswick must be verified.

Dorsum with two large median shields and four pairs of laterally-placed glandularia. Anterior dorsal shield occupying nearly the entire anterior quarter of the dorsum, usually projecting over the anterior margin of the posterior dorsal shield. Posterior dorsal shield narrower, extending almost to the posterior margin of the body. Two narrow, elongate, irregularly-shaped sclerites lateral to the dorsal shield. Sexual dimorphism in the dorsal sclerites generally slight. Glandularia of the dorsum bipartite as in the glandularia of the venter : anterior glandularia with the setigerous sclerite very large; the remaining glandularia small and subequal.

Genital field of the female an ovoid region directly posterior to the anterior coxal plates, marked by concentric sulcations in the integument. A pair of elongate, movable, lateral genital plates centrally located, and a pair of small, irregularly-shaped setigerous glandularia in the antero-lateral angles of the genital field.

Genital field of the male similar but lacking the integumentary sulcations and with the genital sclerites semicircular in shape.

Species of *Hydrovolzia* are tiny (less than a millimeter in length) , bright red animals. In spite of the small size it is possible to recognize *Hydrovolzia* by its peculiar shape and the orientation of the legs which is different from that of other water-mites (Figure 2) .

Hydrovolzia gerhardi new species*

DESCRIPTION. *H. gerhardi* is distinguished from other species of the genus on the basis of measurements which are given in Tables 1 and 2. Chaetotaxy of the legs, palps, and body plates is the same as that described for **the** Palearctic species.

Genital Field. Genital plates of the female with an anterior and a posterior pair of mesially-directed simple setae, and a single, centrally-located, simple **seta** is present in some specimens. Males bearing six setae on the median **margin of the genital plate (occasional specimens lack one or two of these setae)** .

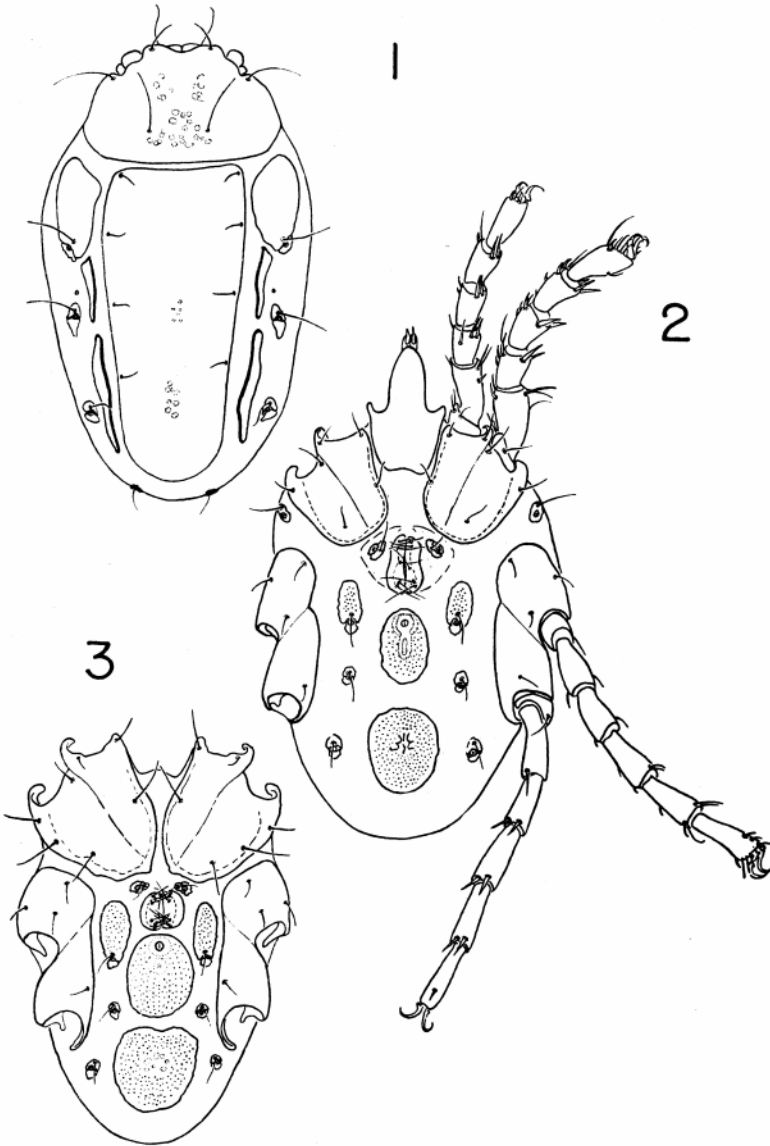
Measurements of the female. Plates of the dorsum large ; anterior dorsal shield **averages 0.180 mm. in length and 0.310 mm. in width, posterior dorsal shield averages 0.525 mm. in length and 0.255 mm. in width.** Plates of the venter smaller ; anal plate averages 0.120 mm. in length and **0.090 mm. in width, post-anal plate averages 0.145 mm. in length and 0.125 mm. in width.**

*This species is named for William J. Gerhard to whom I am indebted for my introduction and early training in entomology.

Table 1. Measurements of the species of *Hydrovolzia*, which are, except where noted, taken from the original descriptions and converted to millimeters. The range is given in parentheses.

	Total length	Anterior			Posterior			Anal		Post-anal	
		Genital plate length	dorsal shield length	dorsal shield width	dorsal shield length	dorsal shield width	Anal plate length	Anal plate width	Anal plate length	Post-anal plate length	Post-anal plate width
Females											
<i>cancellata</i>											
Walter	1.054	.115	.223	.378	.706	.296	.158	.158	.246	.164	
1 specimen											
<i>infringata</i>											
Walter	.585	.065	.180	.265	.415	.220	.160	.155	.125	.165	
1 specimen											
<i>gerhardi</i> n. sp.	.660	.100	.180	.310	.525	.255	.120	.090	.145	.125	
15 specimens	(.565-.760)	(.080-.110)	(.135-.200)	(.275-.350)	(.450-.615)	(.225-.310)	(.100-.145)	(.080-.115)	(.125-.165)	(.095-.155)	
<i>oscensis</i> Viets	.848	.107	.181	.338	.578	.264	.173	.124	.140	.157	
1 specimen											
<i>placophora</i> Monti ¹	.850	.118	.230	.425	.620	.325	.170	.180	.215	.255	
<i>vietsi</i> Angelier	.835	.090	.204	.295	.505	.238	
1 specimen											
Males											
<i>cancellata</i>											
Walter ²	.810	.117	.225	.375	.555	.300	.117	.156	.176	.166	
1 specimen											
<i>gerhardi</i> n. sp.	.618	.065	.180	.315	.475	.245	.115	.110	.125	.130	
15 specimens	(.590-.640)	(.060-.070)	(.160-.190)	(.285-.355)	(.440-.515)	(.210-.265)	(.100-.135)	(.095-.125)	(.105-.140)	(.105-.140)	

¹ Mean of three accounts each from a single specimen (Monti 1905, Thor 1905, and Viets 1930).² Taken from Walter & Motas (1926).



***Hydrovolzia gerhardi* new species**

1. Dorsal aspect, female.
2. Ventral aspect, female.
3. Ventral aspect, male.

Measurements of the male. Plates of the dorsum proportionally a bit larger than in the female ; anterior dorsal shield averages 0.180 mm. in length and 0.315 mm. in width, posterior dorsal shield averages 0.475 mm. in length and 0.245 mm. in width. Plates of the venter proportionally larger than in the female and more ovoid ; anal plate averages 0.115 mm. in length and 0.110 mm. in width, post-anal plate averages 0.125 mm. in length and 0.130 mm. in width.

Table 2. Ratios of length divided by width for the main body plates of the species of *Hydrovolzia* based on the data of Table 1. Range is given in parentheses.

	Anterior dorsal shield	Posterior dorsal shield	Anal plate	Post-anal plate
Females				
<i>cancellata</i> Walter	.59	2.38	1.00	1.50
<i>infringata</i> Walter	.68	1.89	1.03	.76
<i>gerhardi</i> n. sp.	.58 (.52-.64)	2.08 (1.86-2.48)	1.39 (1.22-1.57)	1.18 (1.03-1.28)
<i>oscensis</i> Viets	.54	2.19	1.40	.89
<i>placophora</i> Monti	.54	1.91	.94	.86
<i>vietsi</i> Angelier	.69	2.12
Males				
<i>cancellata</i> Walter	.87	1.85	.75	1.06
<i>gerhardi</i> n. sp.	.57 (.52-.64)	1.94 (1.81-2.17)	1.08 (.96-1.24)	.96 (.79-1.21)

COMPARISONS. Detailed comparisons are only possible for the females for which measurements are given in the literature. Tables 1 and 2 list all the available data and certain salient differences will be discussed here. *H. gerhardi*, *H. oscensis*, and *H. vietsi* are quite similar and these species, together with *H. infringata*, form a group distinctive for the small size of their ventral plates. The anal plate is longer than wide in *oscensis* and *gerhardi* but one-fifth shorter in *gerhardi*. The anal plate of *vietsi* appears to be circular. The post-anal plate of *oscensis* and *vietsi* is wider than long but in *gerhardi* it is longer than wide. The lateral pore-bearing plates of the venter are small in *gerhardi*, proportionally equal to those of *oscensis*, but not as small as those of *vietsi*.

Holotype: an adult female from Rock Creek Canyon, 10 miles northeast of Kankakee, Kankakee County, Illinois ; August 18, 1951. *Paratypes*: same locality as holotype ; July 29, 1950, 1 male, 1 female ; June 6, 1951, 7 males, 12 females ; July 22, 1951, 3 males, 1 female ; August 18, 1951, 25 males, 21 females. The holotype and a series of paratypes will be deposited in the Chicago Natural History Museum.

LARVAE. Larvae were noted at every collection. The tiny (about 0.030 mm. long), bright red animals were seen slowly walking about on the surface film of the water or attached to a common water-bug (*Microvelia americana* Uhler) . A series of twenty larvae was found to agree with the descriptions of *H. placophora* by Walter (1922) and Lundblad (1930) . Lundblad's brief, but accurate, listing of the important features of *H. placophora* appears to be as adequate characterization of *Hydrovolzia* larvae as is now possible :

"The dorsal shield is well chitinized, bearing two lateral bristles. The most striking feature is the two pseudostigmata-like bristles behind the laterally situated eyes.

"The capitulum is also of a curious shape, large, with strongly developed, membranous sides, covering the palps, which are inserted for moving in a nearly horizontal direction. The first segment is small, the second huge with a powerful, curved dorsal side. This segment recalls that of the *Limnochares*-larva. The ventral side is somewhat indistinctly dentated and provided with a small, finger- or spine-like projection." (Lundblad, 1930, p. 5.)

LIFE HISTORY. *Hydrovolzia gerhardi* parasitizes a rather widespread, common hemipteran, *Microvelia americana* Uhler (determined by William J. Gerhard) . Parasitism of *M. americana* approaches 100 per cent and the numbers of mites on a given host may exceed 20 with the result that the host is less active or even immobilized. Larvae can be found attached to any part of the host's body and are in various degrees of engorgement. Preservation so alters the body shape that meaningful measurements can not be made, but it is clear that engorged larvae are never more than twice the size of unengorged specimens. Following the period of parasitism the mite passes through the active nymph and the adult stage at which times the animal is presumed to be predatory.

ECOLOGY. *H. gerhardi* is known only from seepage areas in Rock Creek Canyon, 10 miles north of Kankakee, Illinois. Observations have been made at irregular intervals during the summers of 1950, 1951, and 1952. Ecology of *Hydrovolzia* and the other three water-mites found in seepage areas at this locality will be compared.

As Rock Creek approaches the Kankakee River from the north it cuts through the limestone bed-rock to form a deep, steep-sided canyon. At several spots along the limestone walls of the canyon are small areas of seepage where a trickle of water runs down the rock face. A mat of vegetation may develop at the seeps, predominantly moss in the shade, and usually filamentous algae in exposed areas. A sludge-like deposit may replace the vegetation in some shaded areas. Water temperature of the seeps was around 18° C. as compared to the water temperature of 24° C. recorded in Rock Creek. In these seepage areas three genera of water-mites are commonly found, *Hydrovolzia*, *Lundbladia*, and *Tyrrellia*.

H. gerhardi is extremely limited locally. All but three specimens were taken from a single seepage area about four by six feet in size. The water (13°-18° C.) trickled over a large, convex section of bed rock, and an algal growth seemed responsible for the deposition of the friable, porous, calcareous substrate. The water was characteristically dammed up into tiny pools, one-fourth to one-half inch deep, with a thin layer of silt on the bottom. Adults could be found in this silt, but specimens were most abundant in the interstices of calcareous concretions lying in the flowing water. There were other situations in the canyon that appeared similar and where the host was present but only one of these has ever yielded specimens of *Hydrovolzia* and there only three individuals were taken.

Lundbladia muscicola Mitchell was limited to shady overhanging surfaces where there was no calcareous deposit (the moss or algae may be encrusted but masses of calcium carbonate were not deposited). Generally the rock surfaces were covered with a thin layer of sludge. Of several areas similar in nature and where the host (*Limonia humidicola* O. S.) was present, only one seepage about three by seven feet supported a good population of *Lundbladia muscicola*. Individuals were found at other locations but these may not indicate permanently established populations. A detailed account of this species is given in an earlier paper (Mitchell, 1953).

T yrrellia is now known to be a very common genus in the northeastern United States and is abundant on the wet shores of nearly every type of permanent water. Possibly due to the unfavorable substrate *T yrrellia* was not found along the shores of Rock Creek. The two species of *Tyrrellia* (*T. circularis* Koenike and *T. ovalis* Marshall) were found in most of the seepage areas, but usually close to where the seepage entered the creek.

Lundbladia muscicola, *Hydrovolzia gerhardi*, *T yrrellia circularis*, and *T. ovalis* make up the water-mite fauna of the seepage areas; although, as mentioned above, the species differ in the kind of seepage area they occupy. One other species, an undescribed thysid, is known from two specimens taken in 1950 in association with *Lundbladia*.

It is apparent that the species of *Hydrovolzia* and *Lundbladia*, thought to be relict forms, are very restricted in their local distribution, a restriction certainly not imposed on them by the distribution of their hosts. The precise factors responsible for this distribution will be difficult to determine. An apparent explanation is the lack of suitable habitats, but such an assertion would be unsupported by any evidence.

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